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# Insights into the methodology of radiography science

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ABSTRACT

*Introduction:* The aim of this article is to give an insight into radiography as a science and a discipline from the viewpoints of knowledge interest and methodological approach and design.
*Methods:* Original articles published in Radiography ($n = 184$) and the Journal of Clinical Radiography and Radiotherapy ($n = 10$) at the timeline 2015 to 3/2017 were reviewed for research focus and the methodology used. To abstract the results, thematisation analysis was used.
*Results:* Out of 194 studies analysed, 99 (50%) were found to have a technical, 80 (42%) a practical and 15 (8%) a critical interest of knowledge. The research methodologies used did not rigorously fit into the methodological approach expected on the basis of the interest of knowledge.
*Conclusion:* Radiography as a science seems to have mostly a technical and practical interest of knowledge, but somewhat critical research is also being made. It seems to be a remarkably open and flexible science when it comes to the use of research methodologies. More discussion and research on the science name and paradigm is needed in order to strengthen the scientific status of radiography.


## Introduction

Although it has been seriously debated for about 40 years whether radiography should be a scientific field of its own,[1] radiography as a scientific discipline separate from other allied sciences is quite young.[2] There is still even debate about the name of the discipline. Reviewing from the internet (by using Google search engine) the websites of the universities giving education in the field through the world with the search terms 'radiography science and education', we can find a wide variation in the titles for the science radiography as profession is based on: radiography science, diagnostic radiography, radiotherapy or radiation therapy, medical imaging, radiologic science – radiography, radiographic science. Just to mention a few to demonstrate the conceptual heterogeneity. The European Federation of Radiographer Societies[3] speaks simply about radiography. Based on theoretical study analysing the focus and basic concepts of radiography, Sorppanen[4] suggests that the name of the science could be clinical radiography.

The concept of the science paradigm is central when discussing a scientific discipline. In layman's terms, a scientific paradigm can be defined as a viewpoint on how a particular discipline views phenomena under its focus.[5–7] According to Kuhn[8] the paradigm of science describes: what is to be observed and scrutinized, the kind of questions that are supposed to be asked and probed for answers in relation to this subject, how these questions are to be structured, and how the results of scientific investigations should be interpreted. In short, a paradigm is a comprehensive model of understanding that provides a field's members with viewpoints and rules on how to look at the field's problems and how to solve them.[8] According to Guba,[5] epistemology responds to a question 'How do you know something?'. The research methodology is about how you find it out. A scientific discipline contains the basic paradigm of the science: concepts, methodologies, knowledge base and theories of the particular science.[9–11]

To discuss the research focus and the types of knowledge produced in science, Habermas[12] identified an epistemology with three interests of knowledge: the analytical technical interest producing causal explanations with an aim to predict, the practical-hermeneutic interest aiming to interpret and understand, and the critical-emancipatory interest aiming to criticise and reflect.[12–14] Examples of these three areas of knowledge would be the natural sciences or mathematics in the analytical-empirical sphere, the social sciences or humanities in terms of hermeneutic-historical aspects, and political theory or psycho-analysis as a means of conceptualising our critical-emancipatory aspirations.[13] Interests of

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knowledge are associated with the research methodologies and methods used. When we look for causal explanations, empirical-analytic methods are used. On the other hand, when the aim is to understand phenomena, hermeneutic methods are preferable. When the purpose of the research is criticism and reflection, critical theory methods are used.[12,14] This frame of knowledge interests may also be useful in discussing radiography as an art and discipline.

Over 40 years ago, Hammic[15] defined radiography as a human technical science acting in the interface of technology and people. According to the European Federation of Radiographer Societies,[3] the scope of radiography research activity should incorporate: clinical practice and optimal application across imaging and radiotherapy sub-specialties; technology development; patient care; education; and leadership and management for medical imaging, radiotherapy and nuclear medicine professional pathways. There is little theoretical research on (clinical) radiography from the viewpoint of its scientific domain and essence. Lundgren et al.[16] studied radiography students' views on the discipline. The students identified an interdisciplinary area of knowledge at the abstract level and, at the practical level, described radiography with these attributes: mastering medical imaging, accomplishing images for diagnosis and interventions, creating a caring environment, and enabling fruitful encounters. Sorppanen[4] suggests three main research foci which are also the basic concepts of clinical radiography science. These are: 1) the radiographer's work within health care which is a seamless combination of patient care and service as well as technical usage of radiation and radiation protection; 2) the physical and functional environment in health care, the cultural and cognitive environment, and the context of a radiographer's expertise; as well as 3) health and illness.

Methodological approaches suggested for radiography science in the literature include the qualitative and quantitative approaches,[15] the qualitative approach,[17,18] oral history such as written, audio and video documents and interviews of eyewitnesses to events under investigation,[19] the Delphi technique,[20] and the evidence-based method comprising systematic and integrative reviews.[21] Methodological approaches closely link with research designs. As the quantitative and qualitative methodological approaches both have their own typical designs, we inspect both methodological approaches and methods together in this study.

The aim of this article is to give an insight into radiography as a science and discipline from the viewpoints of a) type of knowledge interest and b) a methodological approach/design.

## Methods

The total sample of original articles published in Radiography ($n = 184$, out of which 47 were online articles) and the Journal of Clinical Radiography and Radiotherapy ($n = 10$) at the timeline February 2015 (issue 1) to August 2017 (issue 3) were reviewed for research focus and the methodology used. Only original articles containing empirical research and systematic or integrative reviews were included. Case studies and narrative reviews were excluded because narrative review is not research and case studies are typically case descriptions often without sound methodologic approach. This review does not intend to be a systematic review or a systematic search since the data we use is a total sample of articles published during a specific timeline. For this reason, the quality of the research articles was not evaluated. In the results chapter of this article, only the number of findings without references is reported, not referring to the original articles, because the data of this review can be found in the volumes of Radiography and the Journal of Clinical Radiography and Radiotherapy. Another reason for this is that giving the references of all the articles reviewed would have expanded the reference list of this article too much.

The articles were reviewed blinded by both authors. The articles were tabulated into an Excel table documenting the reference, purpose and aims of the study as well as the methodological approach. Disagreements on classification ($n = 23/194$, 12% of the articles), regarding either the knowledge interest or the research methods, were all solved by negotiation between the two researchers. In this negotiation both researchers argumented their viewpoints and the decision was made based on compromise. After this, a theory driven thematisation analysis was performed to identify the research foci and methodological approaches used in the tabulated studies.

The classification of the studies according to the research methods was made taking into account Habermas[12,13] epistemology regarding three interests of knowledge: A = the analytical technical interest producing causal explanations with an aim to predict using empirical methods like cross sectional surveys, clinical studies and interventional studies. These are traditionally being used in natural sciences; B = the practical-hermeneutic interest aiming to interpret and understand using interpretative methods like ethnographic or phenomenological approach commonly used in humanities and social sciences; C = the critical-emancipatory interest aiming to criticise and reflect. Examples of these methods are action research and grounded theory approach. These methods are commonly being used in critical social sciences and e.g. in feministic research. Keeping in mind the association between the types of information needed to respond different interests of knowledge the research methods used in the research articles of this review were classified into 17 categories.[12,13]

## Results

### *Epistemology in radiography research*

Out of 194 studies analysed, 99 (50%) were found to have a technical interest of knowledge aiming to describe, assess, compare, explain or develop medical, procedural or technical solutions by means of radiography research. These studies focused most typically on radiographer role development and education, image interpretation, comparing imaging/radiotherapy techniques and modalities, and post processing developing protocols mostly in MRI. There were also studies about workflow development, economic evaluation, the implementation of guidelines or processes, improving quality and patient safety, radiation risk and optimization, patient care in radiography, side effects, and adverse events.

Many studies ($n = 80$, 42%) were found to have a practical interest of knowledge aiming to identify, describe or understand phenomena in the field of radiography. These studies were about describing and identifying phenomena and examining patients' feelings, their perceptions about examinations and examination risks, interactions between radiographers and patients, and patient safety. There were also studies on radiographer students' experiences and attitudes, radiographers' perceptions about technical developments e.g. in CT and MRI, optimization and image quality, service or professional development, pedagogy in radiography education, continuous professional development, radiography practice and communication, workplace wellbeing, and management. There were only two studies in these data describing radiography research priorities. We found 15 studies (8%) having a clearly critical interest of knowledge aiming to question unfavourable existing structures, positions, domains, roles, expectations, values or barriers (Fig. 1).

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